



# Canada in a Changing Climate: Health Impacts Research and Implications for Successful Adaptation

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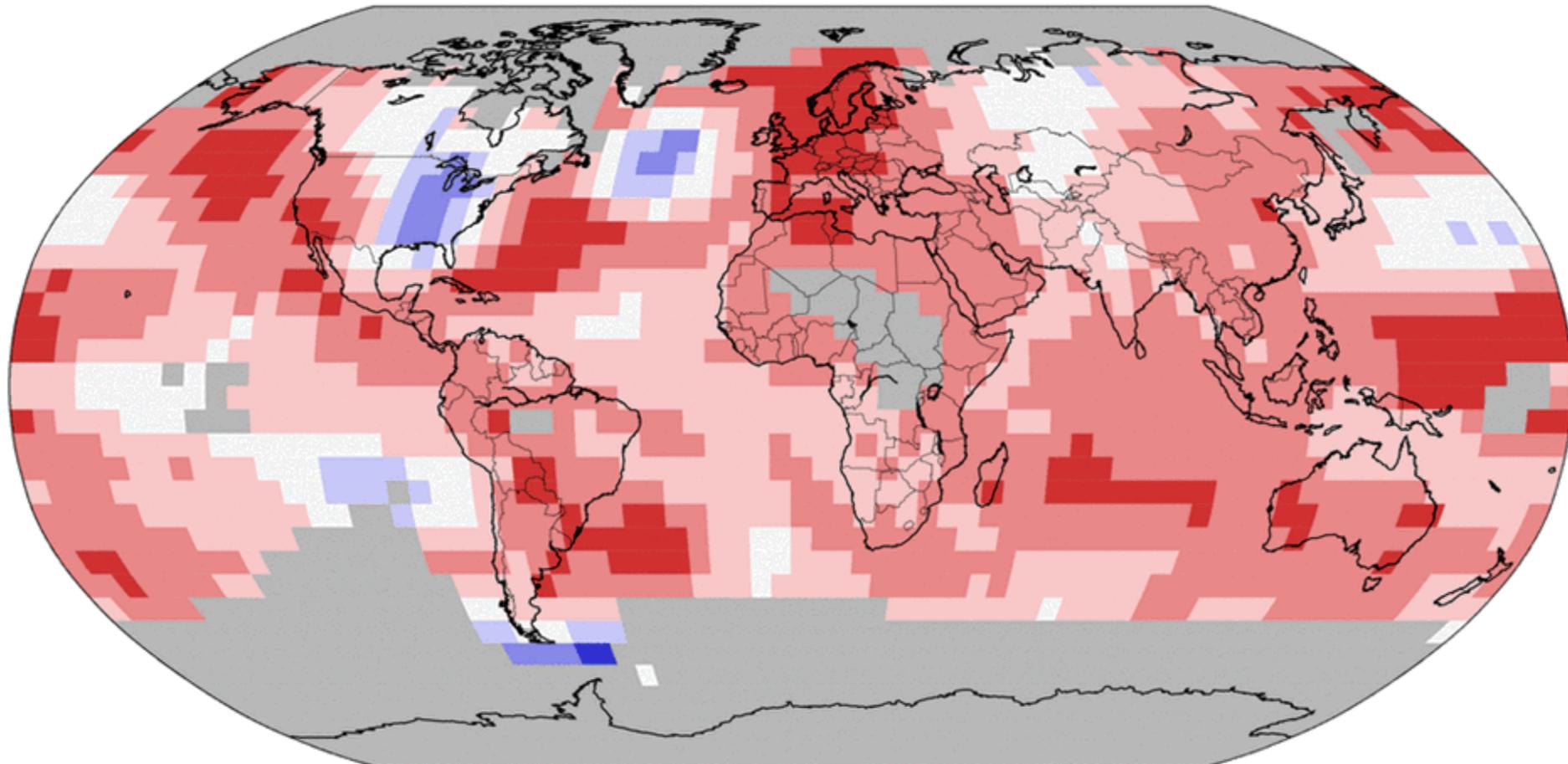
**Public Health Ontario**  
**Occupational & Environmental**  
**Health Seminar**  
**February 26, 2015**



# Land & Ocean Temperature Percentiles Jan–Nov 2014

NOAA's National Climatic Data Center

Data Source: GHCN–M version 3.2.2 & ERSST version 3b



  
Record  
Coldest

  
Much  
Cooler than  
Average

  
Cooler than  
Average

  
Near  
Average

  
Warmer than  
Average

  
Much  
Warmer than  
Average

  
Record  
Warmest



# Health Impacts of Climate Change

Climate Change  
 Health Impacts



Extreme Events

Gradual Change



Natural Environment

Built Environment

Social Environment



on the social determinants of health

Determinants of Health

Physical Environment

Personal Health Practices

Employment/ Working Conditions

Health and Social Services

Social Networks

Culture



Health Impacts

Temperature- related Illnesses

Vector-borne diseases

Effects of water and food contamination

Air-pollution health effects

Extreme weather events

Social and economic changes



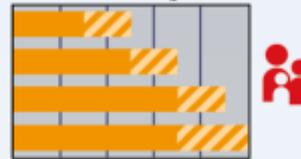
# Regional key risks (IPCC Synthesis Report 2014)

## Polar Regions (Arctic and Antarctic)

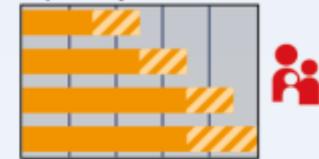
### Risks for ecosystems



### Risks for health and well-being



### Unprecedented challenges, especially from rate of change

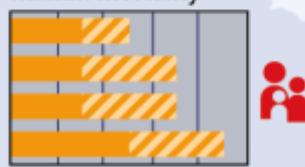


## North America

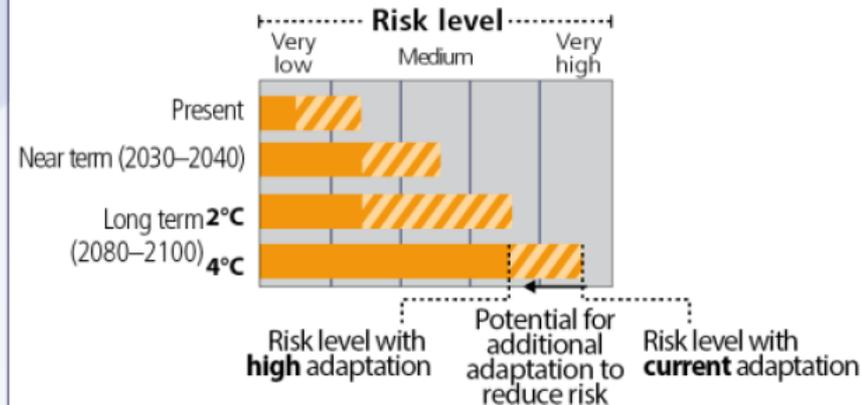
### Increased damages from wildfires



### Heat-related human mortality



### Increased damages from river and coastal urban floods



## Representative key risks for each region for

**Physical Systems**

- Glaciers, snow, ice and/or permafrost
- Rivers, lakes, floods and/or drought
- Coastal erosion and/or sea level effects

**Biological Systems**

- Terrestrial ecosystems
- Wildfire
- Marine ecosystems

**Human & Managed Systems**

- Food production
- Livelihoods, health and/or economics

# Major Categories of Health Impacts

- Injuries, disease and deaths due to more intense heat waves and fires } Very High Confidence
- Under-nutrition resulting from diminished food production } High Confidence
- Food and water-borne diseases } Very High Confidence
- Vector-borne diseases } Medium Confidence
- Modest improvements in cold-related mortality and morbidity in some areas } Low Confidence



# A Call to Action for Health

***“Climate change...the defining issue for public health during this century”***

Dr. Margaret Chan, Director General, WHO, 2007

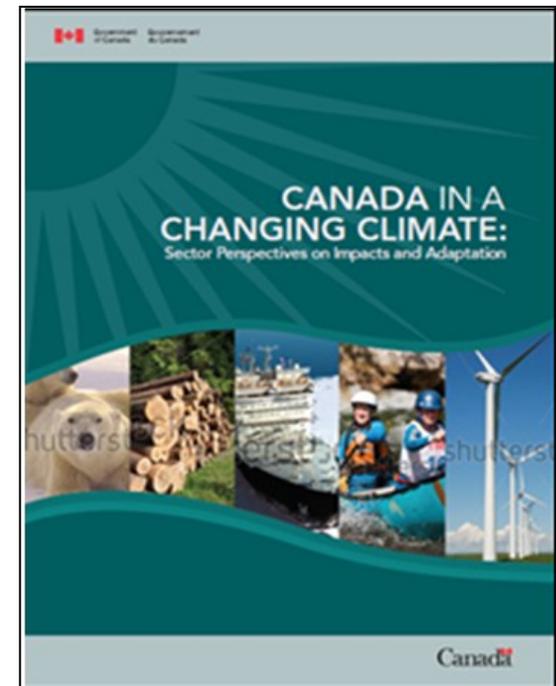
**But Also** – American Public Health Association (2010),  
Lancet Commission (2010), and US  
Environmental Protection Agency (2013)



# Assessment Update 2014

## Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation

- Update to the 2008 report *From Impacts to Adaptation: Canada in a Changing Climate*
- Assesses literature published since 2007 on climate change impacts, adaptation and vulnerability in Canada
- Includes chapters on natural resources, food production, industry, biodiversity and protected areas, **human health**, and water and transportation infrastructure.
- Targets decision-makers from government, business and industry, science and policy advisors and university level instructors and students



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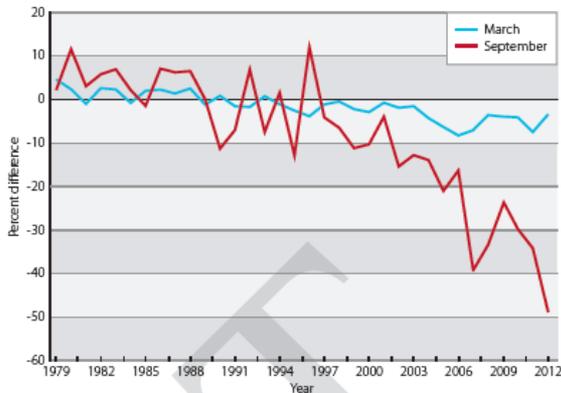
# Assessment Update 2014: Key Findings



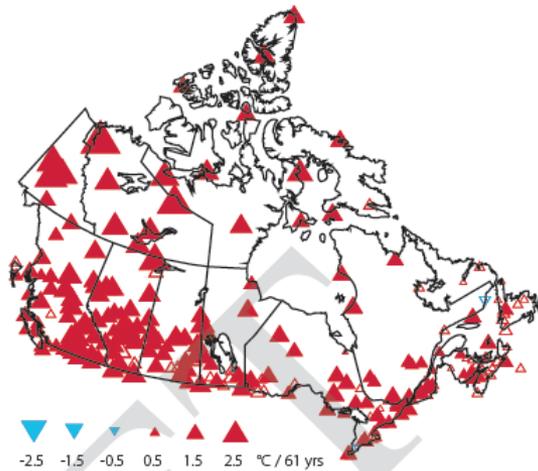
# Canada's Changing Climate

Canada's changing climate affects pathways through which impacts on the health of Canadians and the health sector occur

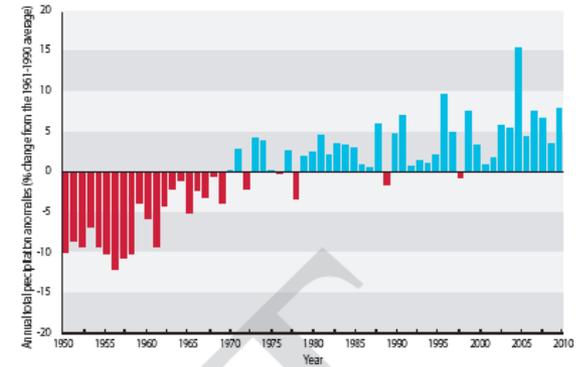
## Decreasing sea ice extent



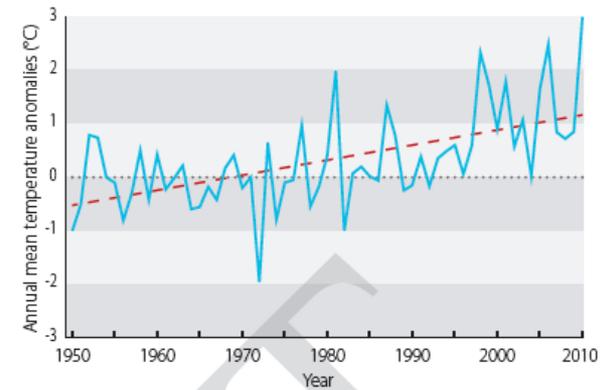
## Amount of warming varies across Canada



## Increasing Precipitation



## Warming trend of 1.5° C



# Key Findings

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*There is stronger evidence of the wide range of health risks to Canadians posed by a changing climate*

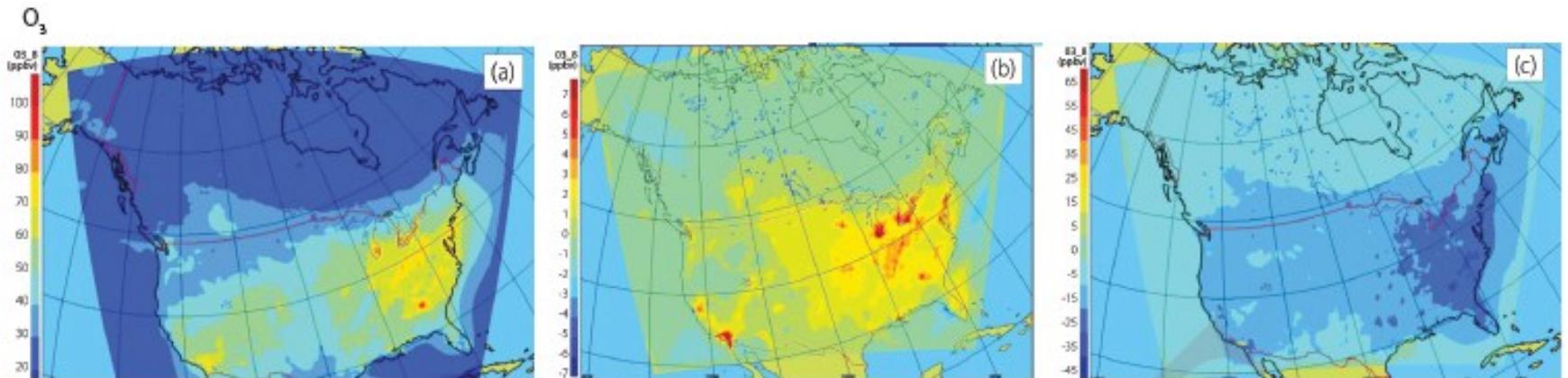


# Health Risks from Impacts on Air Quality

## Ambient Air

Climate change will increase health risks from poor air quality (e.g., O<sub>3</sub>, PM, alleroallergens)

Between 1995 and 2009, the length of the ragweed season increased by 27 days in Saskatoon and 25 days in Winnipeg



# Health Risks from Impacts on Air Quality

Air Contaminants	Climate Change and Related Drivers	Health Risks
Ground-level ozone	Increased temperatures	<ul style="list-style-type: none"> <li>• Premature mortality</li> <li>• Respiratory symptoms, inflammation</li> <li>• Impacts on immunological defences</li> <li>• Cardiac effects</li> <li>• Adverse long-term respiratory impacts</li> </ul>
Particulate matter - coarse (PM <sub>10-2.5</sub> ), fine (PM <sub>2.5</sub> ) and ultrafine (PM <sub>0.1</sub> )	Wildfires Drought Renovations to weatherize buildings	<ul style="list-style-type: none"> <li>• Mortality</li> <li>• Cardiac outcomes</li> <li>• Lung cancer mortality</li> <li>• Restricted activity days</li> <li>• Respiratory symptoms</li> <li>• Bronchitis</li> <li>• Asthma exacerbation</li> </ul>
Aeroallergens (eg., from trees, grasses, weeds, molds, dustmites)	Warmer temperatures	<ul style="list-style-type: none"> <li>• Allergic responses in sensitized individuals</li> <li>• Exacerbation of respiratory diseases (e.g., asthma and chronic obstructive pulmonary disease)</li> </ul>
Fungi (e.g., and infectious bacteria)	Moisture in buildings from infiltration of rain or flooding Poorly designed ventilation and air-conditioning systems Poor building maintenance Warmer and drier summers in western Canada	<ul style="list-style-type: none"> <li>• Respiratory disease</li> <li>• Cryptococcal disease (cryptococcosis) which can result in pneumonia or meningitis</li> </ul>
Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs)	Dampness in buildings	<ul style="list-style-type: none"> <li>• Asthma</li> <li>• Allergies</li> </ul>
Carbon monoxide (CO)	Use of portable gas-powered or electric generators, oil and gas furnaces, fireplaces, or candles during weather-related emergencies	<ul style="list-style-type: none"> <li>• Fire-related injuries and death</li> <li>• CO poisoning</li> </ul>



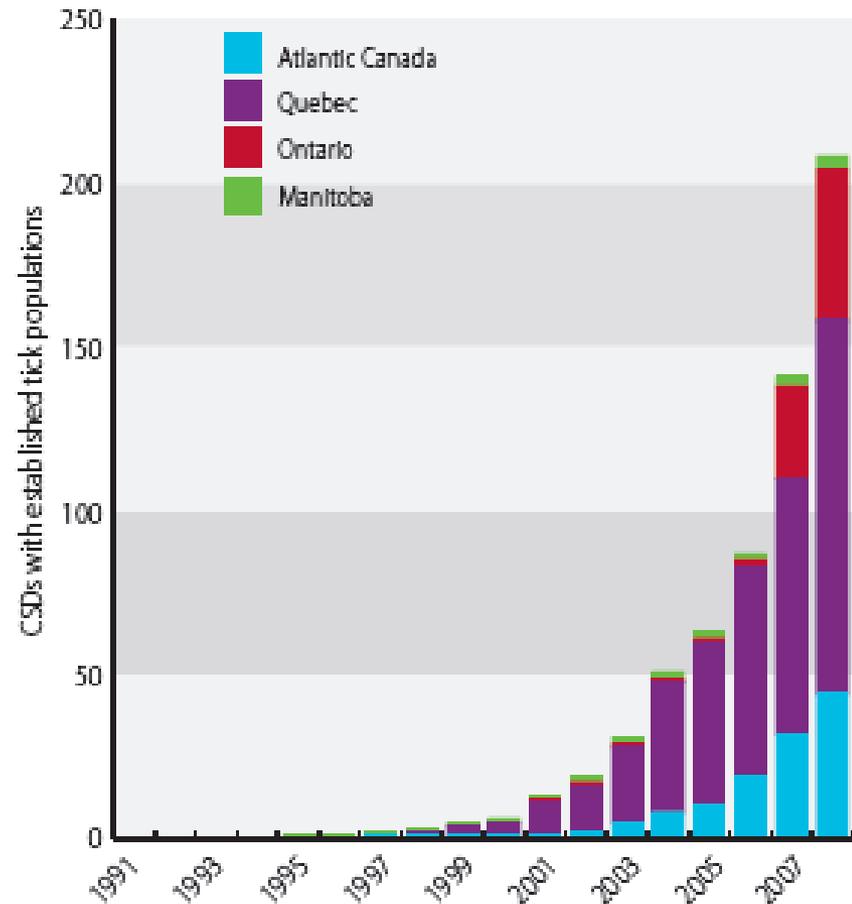
# Food and Water Quality at Risk

- Greater confidence of link between cases of **salmonellosis** and higher temperatures and between acute **gastrointestinal illness** and both high and very low precipitation levels
- Limited information on climate change impacts on **food security** and health in southern Canada but significant concern in northern Canada
- Climate change could affect pathways by which **chemical contamination** occurs in water bodies (e.g, pesticides, nutrients, POPs) through flooding, storms and precipitation

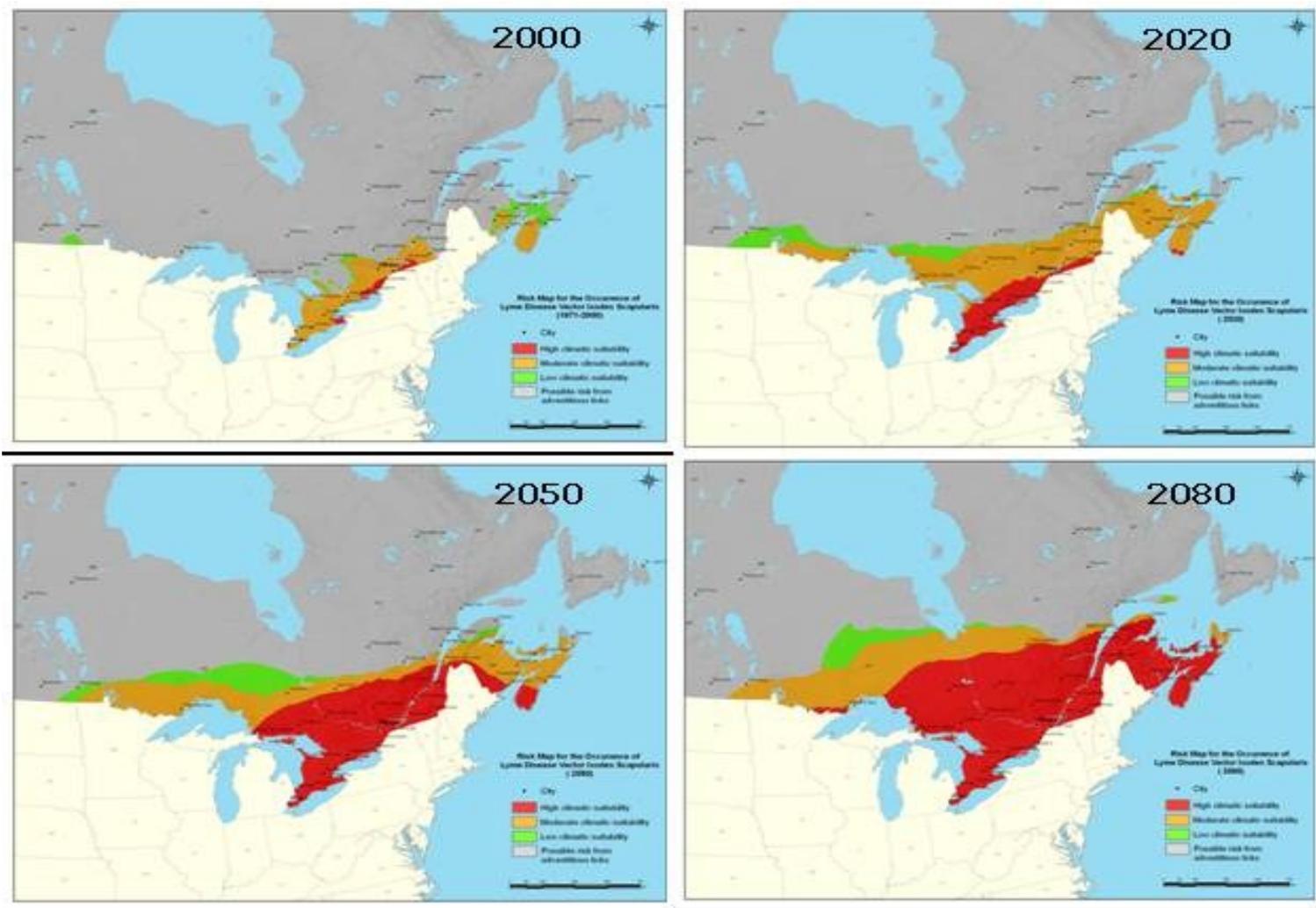


# Vector-borne Disease Emergence in Canada

- Emergence of Lyme risk in the Canadian environment is underway - the annual incidence of Lyme disease has increased from approximately 30 cases a year to over 250 in recent years
- Lyme vector is spreading into Canada at a rate of 35-55km per year



# Risks from Lyme Disease will Continue to Grow



## Key Findings

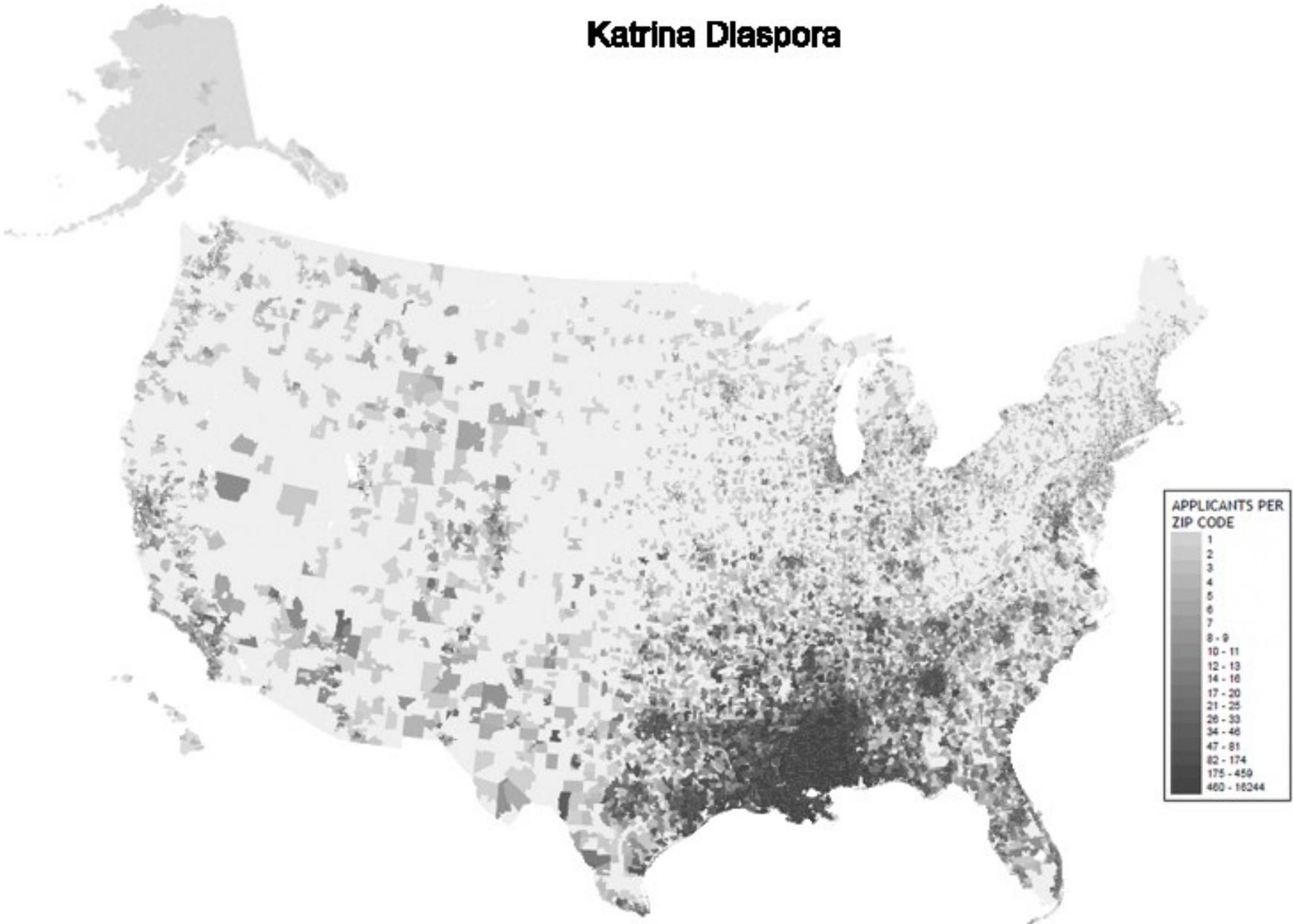
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*A range of climate-related natural hazards continue to impact communities, presenting increasing risks to health in the future*



# Hurricane Katrina - 800,000 Americans Displaced

## Katrina Diaspora

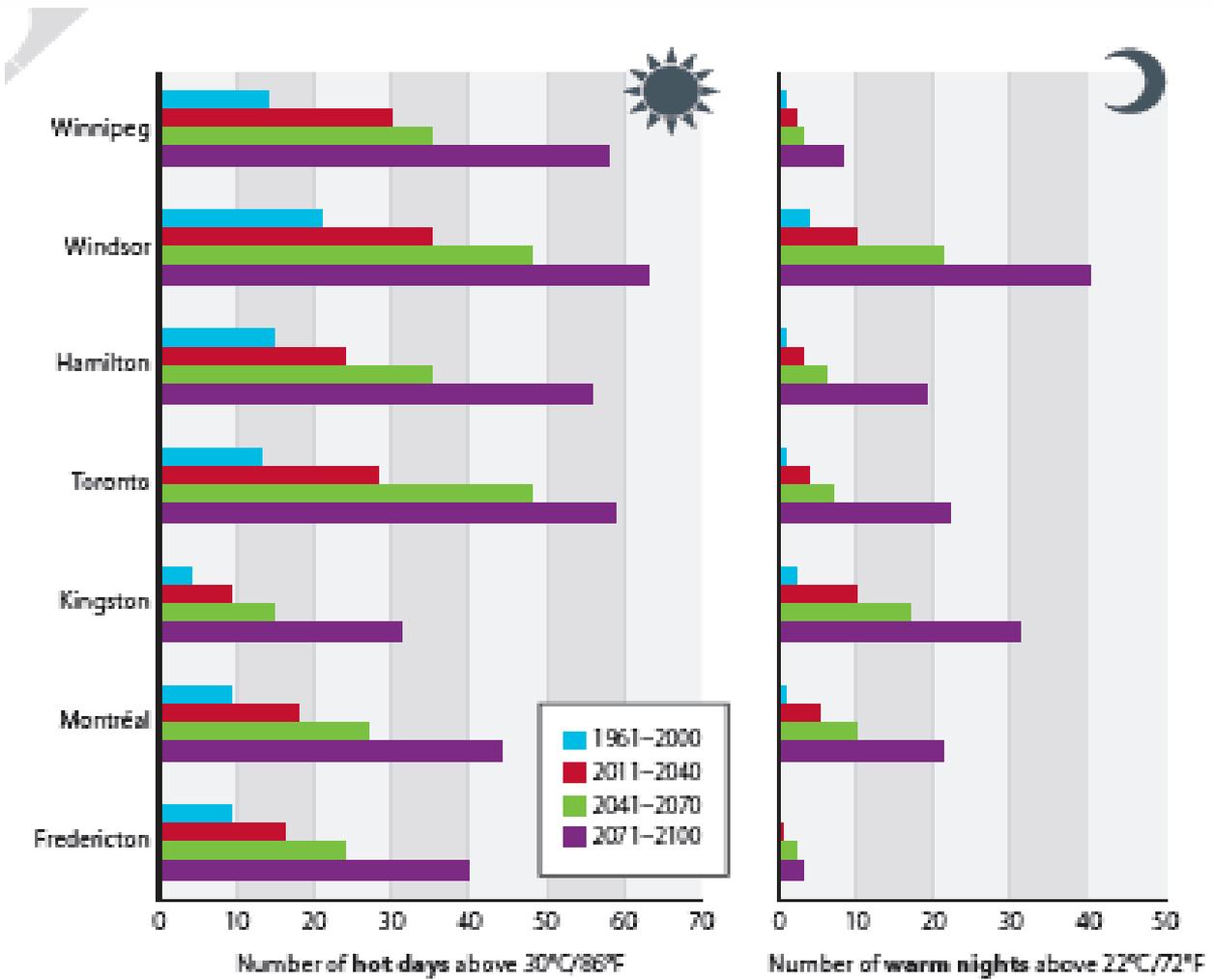


# Increased Frequency and Severity of Natural Hazards

- Climate change can result in **“unprecedented” extreme events** with severe impacts on individuals and communities
- **Limited surveillance** of health impacts from extreme weather events in Canada – national level data are sparse
- Storms can affect health through the **disruption of medical care** and other social services



# Extreme Heat in Canadian Communities



# Drought Impacts on Health

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- Droughts can lead to lower groundwater levels and stream flows, increase wind erosion of soils, and cause cracking of cisterns and cracked septic tanks – and therefore increase in **water borne pathogens** and water contamination leading to gastroenteritis
- Droughts can facilitate spread of certain **vector-borne diseases** and lead to suboptimal nutrition due to food shortages, lack of food availability, and high costs
- Droughts can also increase **stress and mental health issues**



# Brazil Drought 2015

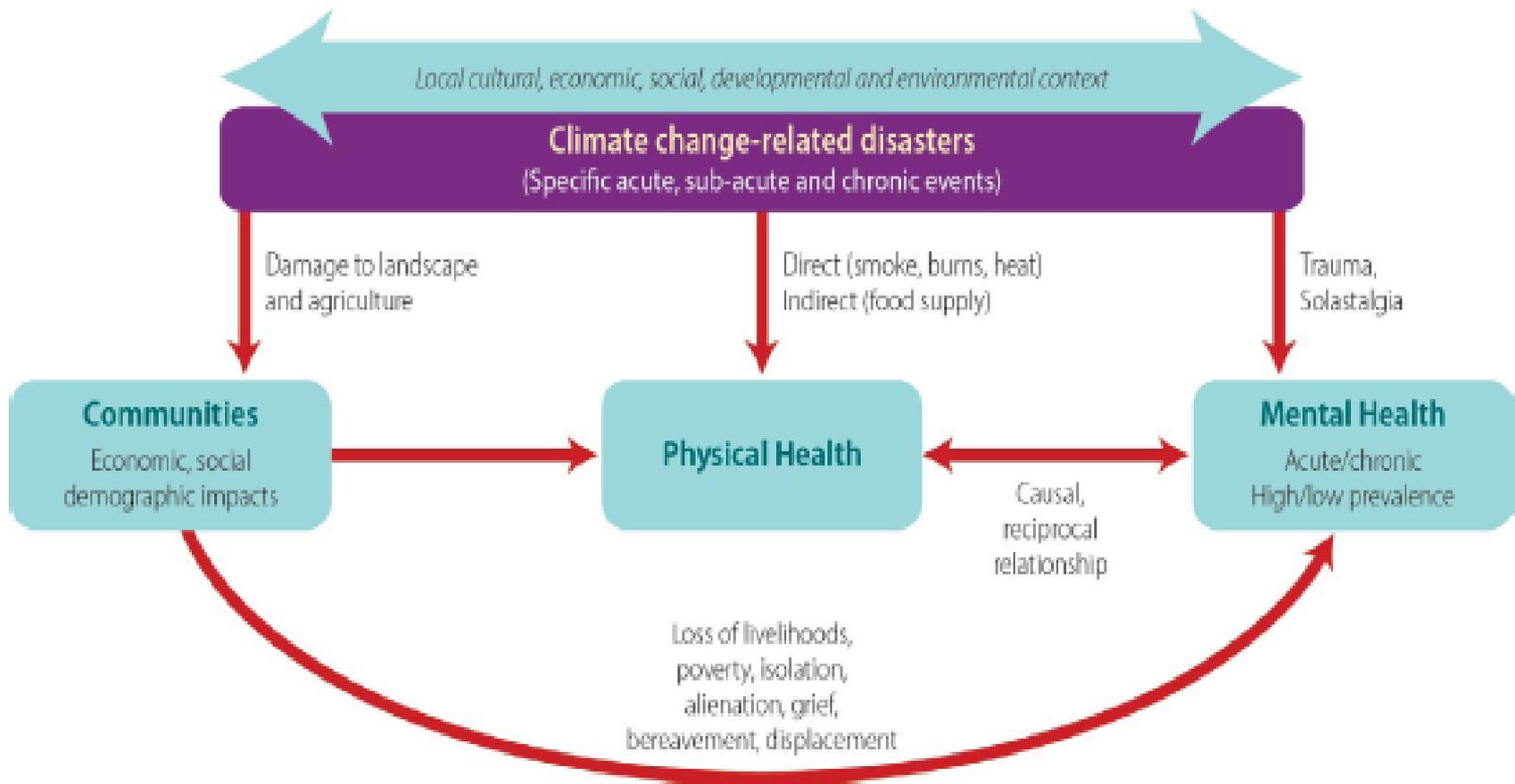
- People stockpiling water in apartments, drilling wells and other emergency measures
- Large hospitals installing in-house water treatment and recycling centers to be able to carry out surgeries and other services
- Dengue fever cases in Sao Paulo have tripled with people collecting rainwater in open buckets



<http://amazonwatch.org/news/2014/0313-from-floods-to-drought-brazils-energy-sector-faces-a-catastrophic-year>



# Psychosocial Impacts of Climate Change



## Key Findings

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*Provincial, territorial and local health authorities are gaining more knowledge of climate change and health vulnerabilities through assessments and targeted research*



# Urban and Rural Vulnerability to Health Impacts

Key Vulnerability Factors	Examples of Urban Characteristics	Examples of Rural Characteristics
<p>Exposure</p> <ul style="list-style-type: none"> <li>• Geography</li> <li>• Land use</li> <li>• Climate</li> </ul>	<ul style="list-style-type: none"> <li>• Complex infrastructure, high density buildings and landscape dominated by impervious surfaces</li> <li>• Higher population density</li> <li>• Higher air pollutant levels</li> </ul>	<ul style="list-style-type: none"> <li>• Increased health risks from water contamination due to a high reliance on small drinking water systems</li> <li>• More people employed in outdoor occupations</li> <li>• Higher risk of exposure to land-shifts, wildfires, vector borne diseases and floods</li> </ul>
<p>Individual Sensitivity</p> <ul style="list-style-type: none"> <li>• Age and Gender</li> <li>• Health status</li> </ul>	<ul style="list-style-type: none"> <li>• Ageing population</li> <li>• Cardiovascular and respiratory conditions in large urban centers from air pollution and extreme heat</li> </ul>	<ul style="list-style-type: none"> <li>• High elderly population and high incidence of chronic illnesses, smoking and obesity</li> </ul>
<p>Key Adaptive Capacity Factors</p> <ul style="list-style-type: none"> <li>• Socio-economic status</li> <li>• Public services and risk communication programs</li> <li>• Employment</li> </ul>	<ul style="list-style-type: none"> <li>• Greater prevalence of high risk population groups, with limited adaptive capacity (e.g. low socio-economic status)</li> <li>• Higher prevalence of social isolation and limited access to services (e.g. immigrants, First Nations, homeless or persons of low income or with mental illnesses)</li> <li>• High reliance on critical infrastructure for health care and emergency service provision that are vulnerable to extreme weather</li> </ul>	<ul style="list-style-type: none"> <li>• Limited access to services during extreme events (e.g. power, water, food, medical)</li> <li>• Limited availability and accessibility of public services and programs and communication venues to deliver health and emergency messages</li> <li>• High dependency on natural resources that are vulnerable to disruption from extreme weather</li> <li>• Lower proportion of population highly educated</li> <li>• Limited livelihood and economic diversification</li> <li>• Limited resources and services to respond to extreme weather events and associated health burdens</li> <li>• Limited service access in remote communities</li> </ul>

**TABLE 6:** Urban and rural characteristics that increase vulnerability to climate change and climate-related impacts.

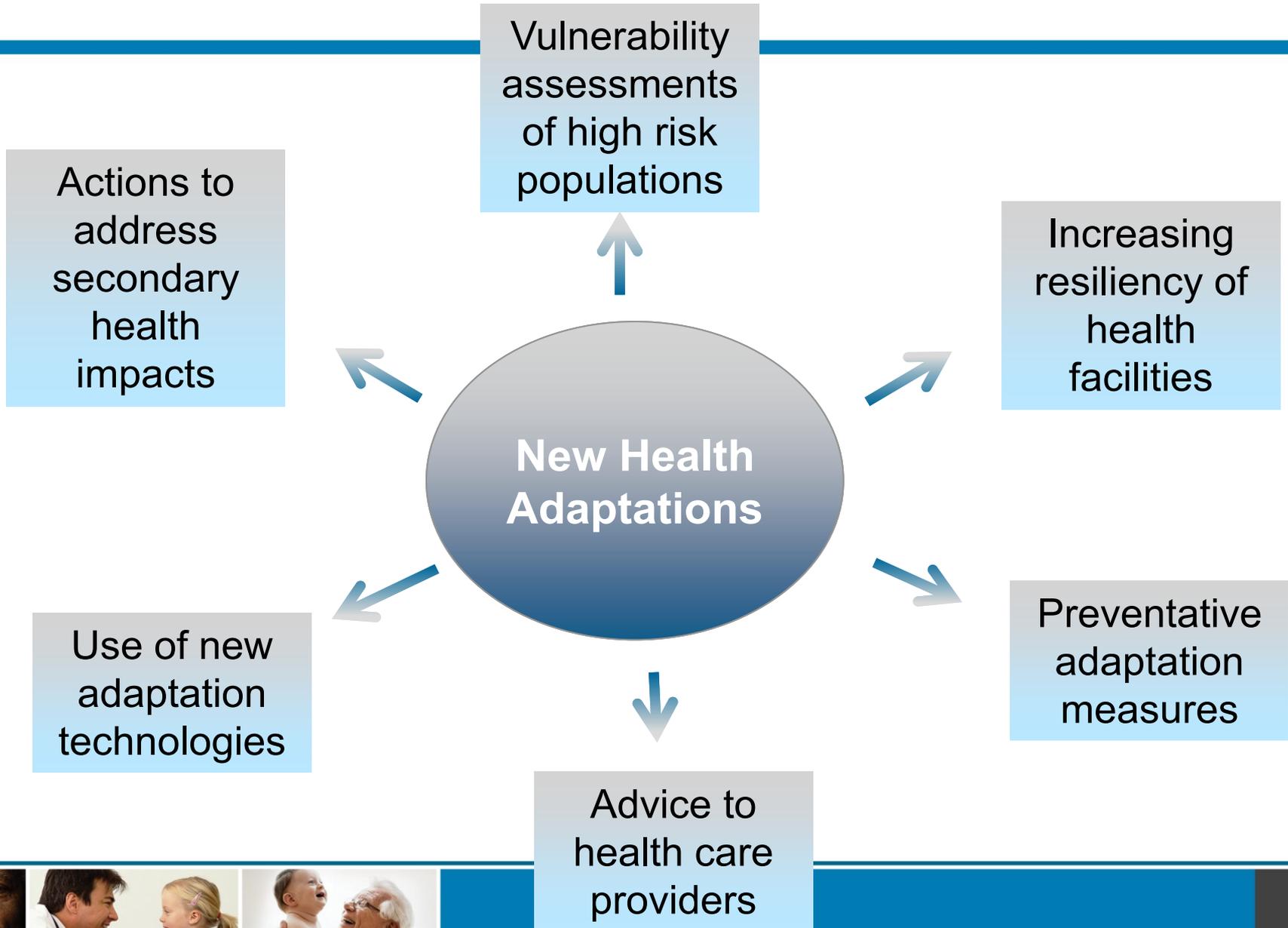
## Key Findings

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*Adaptation tools and measures, such as heat alert and response systems, projections of vector-borne disease expansion and greening urban environments can help protect Canadians from the effects of climate change being felt now and those from future impacts*



# Innovative Adaptations



# New Tools for Adaptation

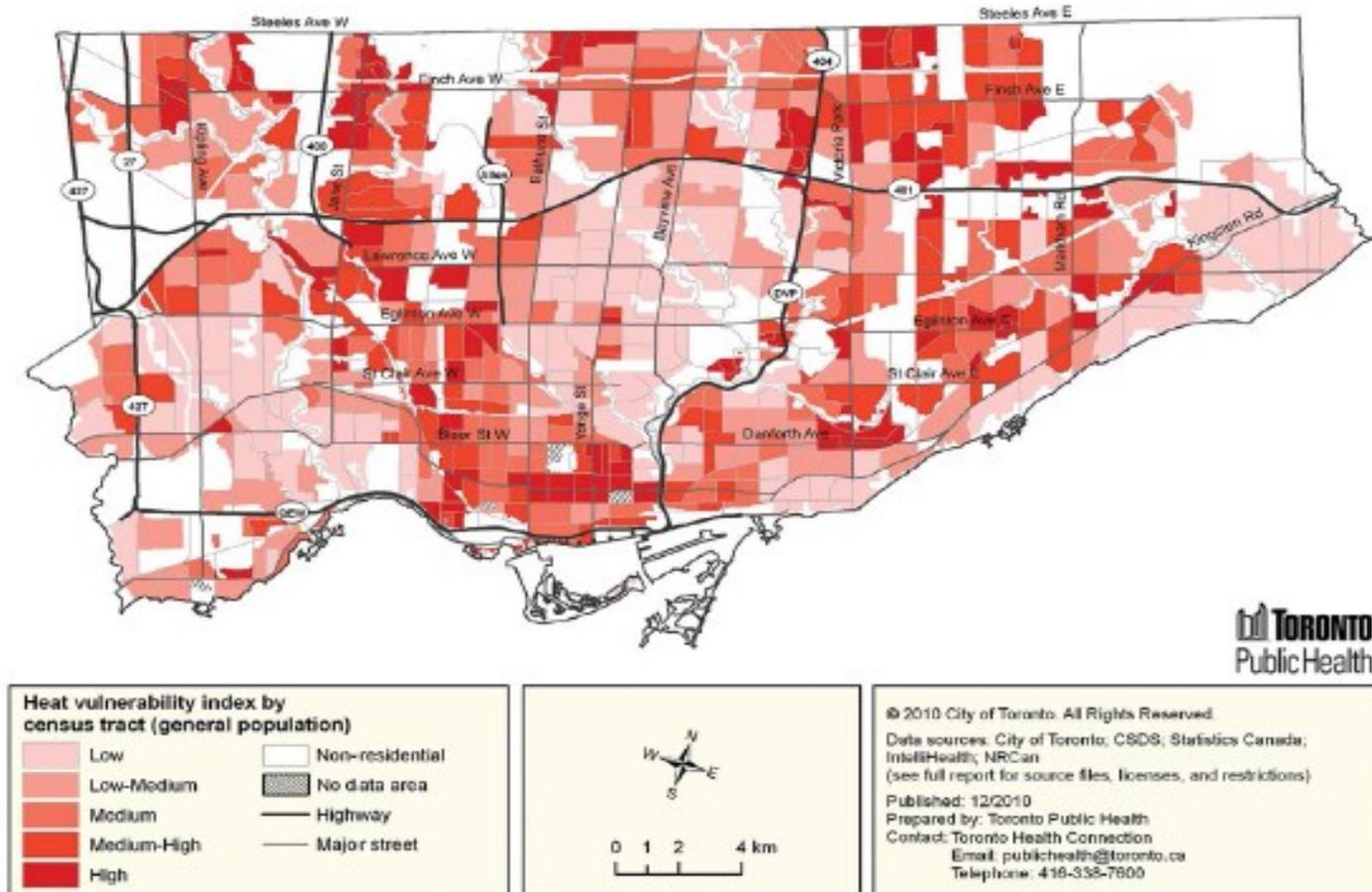


FIGURE 9: Vulnerability to heat in Toronto (Source: Toronto Public Health, 2011a).



# New Adaptation Technologies

## Smart Windows



<http://www.treehugger.com/clean-technology/smart-windows-may-become-reality-thanks-new-nano-coating.html>

## Green Walls



<http://www.modernhippiemag.com/tag/green-walls/>

# State of Health Adaptation in Canada

*Adaptation can contribute to the wellbeing of current and future populations, the security of assets and the maintenance of ecosystem services now and in the future as the climate changes*

- Relative to other countries Canada is making progress on health adaptation
- Canadian expertise on climate change and health issues is growing and many universities and organizations are undertaking research in this area
- Few health authorities at regional and local levels have conducted full climate change and health vulnerability assessments
- Has been increase in number of provinces and territories that have included climate change and health information and considerations in their climate change plans

